

Appl. No. 10/807,851
Response dated February 23, 2006
Reply to Office Action of November 23, 2005

Amendments to the Drawings

The attached sheets of drawings include changes to the drawings. Attached sheet 2/11 replaces the original sheet 2/11. In the drawing, the headings, --Without Internal Structures-- and --With Internal Structures--, have been inserted underneath Figures 2a and 2b, respectively.

Attachment: Replacement Sheet
Annotated Sheet Showing Changes

Appl. No. 10/807,851**Response dated February 23, 2006****Reply to Office Action of November 23, 2005****REMARKS**

Applicants acknowledge receipt of the Office Action dated November 23, 2005. By this Response, Claims 19, 36, 45, 46, 48, 52, 53, 55-56, and 68-69 are amended and Claims 35, 49-51, and 59 are cancelled. Claims 19-33, 36-46, 48, 51-58, and 60-69 are now pending in the application. The Examiner has objected to the specification and drawings for informalities. The Examiner has rejected Claims 19-33, 35-46 and 68-69 under 35 U.S.C. §112, second paragraph as being indefinite. The Examiner has also rejected Claim 48 under 35 U.S.C. §102 as being anticipated by Chen et al., "Fluid dynamic parameters in bubble columns with internals," *Chemical Engineering Science* 54 (1999) 2187-2197 (hereinafter "*Chen*"). In addition, the Examiner has rejected claims 19-23, 27, 29, 31, 40, 42, 45, 46, 48, 50, 65, 68, and 69 under 35 U.S.C. §102 as being anticipated by Hagino et al., U.S. Patent No. 4,327,042 (hereinafter "*Hagino*"). Furthermore, the Examiner has rejected Claims 19-25, 29-31, 40-43, 45-50, 53, 54, 57, 58 and 65-69 under 35 U.S.C. §102 as being anticipated by Kolbel et al., U.S. Patent No. 2,553,369 (hereinafter "*Kolbel*"). Moreover, the Examiner has rejected Claims 26-28, 32, 33, 35, 36, 51, 52, 59-61 and 64 under 35 U.S.C. §103 as being unpatentable over *Kolbel*. Additionally, the Examiner has rejected Claims 19, 20-26, 29, 37, 46, 48-50, 53-58, 62, 63, 65, 68, and 69 under 35 U.S.C. §103 as being unpatentable over Garbo, U.S. Patent No. 2,539,415 (hereinafter "*Garbo*"). Applicants respectfully request consideration of the foregoing amendment, the following remarks, withdrawal of the rejections, and allowance of all pending claims.

I. Status of the Claims

By this Response, Claims 35, 49-51 and 59 are now cancelled. Claims 19, 36, 41, 45, 46, 48, 51-53, 55, 56, 68 and 69 are amended. Claims 1-18 and 47 stand cancelled.

The amendments to Claims 19, 45, 46, 48, 68 and 69 are addressed below in the following sections IV to IX addressing the various rejections. The amendments to Claims 36, 41, 52, 53, 55 and 56 do not alter the scope of these claims and are addressed here. Claim 36 was amended to redirect the claim from a now-cancelled Claim 35 to Claim 19. Claims 52, 53, 55, 56 were amended

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to redirect these claims from a now-canceled Claim 49 to Claim 48. Claim 41 was amended to correct a grammatical error.

Claims 19-33, 36-46, 48, 52-58 and 60-69 are currently pending, in which:

- Claim 19 is an independent claim from which Claims 20-33, 36-46, 58 & 60-69 depend;
and
- Claim 48 is an independent claim from which Claims 52-57 depend.

II. Amendment to the Drawings

In response to the Examiner's objection to the drawings, Applicants submit with this Response Replacement Sheets for the drawings of the application. As suggested by the Examiner, Applicants have added to Sheet 2 of 11, the label "Without Internal Structures" and "With Internal Structures" underneath Figures 2a and 2b, respectively.

No new matter was added by way of amendment to these Figures.

III. Amendments to the Specification

Applicants have amended paragraph [0021] of page 6 of the specification as filed to properly identify Figure 2a and 2b.

Applicants have further amended paragraph [0030] of page 10 of the specification as filed to properly identify the walls as "520" and the parallel zones as "510" as shown in Figure 10.

No new matter was added by way of amendments to the specification.

IV. Rejections under 35 U.S.C. § 112

Claims 19-33, 35-46, 48-69 were rejected based on 35 U.S.C. § 112, 2nd paragraph for indefiniteness.

With respect to Claim 19, Applicants have deleted the phrase "low degree of backmixing" in the preamble of such claim. This phrase used in the preamble was merely there to state the purpose of the apparatus design, i.e., to reduce backmixing and to assist the Examiner

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in the selection of the statutory class of this invention. Because this phrase is not in the body of the claim and since the body of the claim does not refer to this phrase in the preamble, it is not necessary to keep it in such claim if in the Examiner's view it leads to ambiguity. Applicants further have amended the claim to recite "wherein said reaction vessel is capable of having a liquid disposed therein." This amendment is supported by the application as filed, for example by originally-filed claim 48. Applicants submit that these amendments should clarify the claim and respectfully request withdrawal of this rejection.

With respect to Claim 45, Applicants have amended Claim 45 to recite "the gas-agitated multiphase reactor further comprises a liquid phase, said liquid phase comprising liquid hydrocarbon synthesis products." This amendment is supported by the application as filed, for example by at least paragraph [0033] of Page 11 of the specification as filed. Applicants submit that Claim 45 is now in condition for allowance and respectfully request withdrawal of this rejection.

With respect to Claim 46, Applicants have amended Claim 45 to recite "the gas-agitated multiphase reactor further comprises a slurry." This amendment is supported by the application as filed, for example by at least paragraphs [0019]-[0021] and [0027] of the specification as filed. Applicants submit that Claim 46 is now in condition for allowance and respectfully request withdrawal of this rejection.

With respect to Claim 48, Applicants have inserted the limitation of original Claim 50 into Claim 48 to clarify the phrase "large diameter reaction vessel." Applicant believes that this amendment cures the indefiniteness rejection.

With respect to Claim 68, Applicants have amended Claim 68 to recite "wherein the gas distributor is suitable for passing a gas flow at a gas linear velocity of about 12 cm/s to about 50 cm/s." Applicants submit that Claim 68 now recites a structural limitation and is in condition for allowance.

With respect to Claim 69, Applicants have amended the claim to recite "are capable of minimizing liquid axial dispersion to achieve a productivity similar to that obtained from a multitude of reactors with diameters of characteristic size D_s ." This amendment is supported by

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the application as filed, for example paragraph [0033] of the specification as filed. Applicants believe that the amendment clarifies the invention and submit that the claim is now in condition for allowance.

In view of the foregoing amendments, Applicants believe that Claims 19, 45-46, 48, and 68-69 are now in condition for allowance. Additionally, because Claims 18-33, 35-44, and 47-67 depend on independent Claims 19 and 48, respectively, they also are now in condition for allowance. Accordingly, Applicants respectfully request withdrawal of the § 112 rejections and allowance of such claims.

V. Claim 48 is not anticipated by *Chen*.

Applicants respectfully traverse the rejection of Claim 48 under 35 U.S.C. § 102(b) as being anticipated by *Chen*. Applicants submit that Claim 48, as amended, is not anticipated by *Chen* because *Chen* fails to disclose each and every limitation of the claims.

By this response, independent Claim 48 has been amended to recite "a means for reducing the liquid axial dispersion coefficient and backmixing within the reaction vessel, said means for reducing comprising a non-uniform distribution of internal structures arranged in such a manner to create a plurality of discrete zones within the reaction vessel, wherein the internal structures comprise an area of about 10% to about 25% of the cross-sectional area of the reaction vessel". This amendment is supported by the application as filed, for example by at least previously-presented Claims 16, 59 and paragraph [0039] of the specification as filed (see Page 13). Furthermore, the limitations of original Claims 49-51 were also inserted into Claim 48.

Nowhere does *Chen* disclose said means for reducing comprising a non-uniform distribution of internal structures arranged in such a manner to create a plurality of discrete zones within the reaction vessel, wherein the internal structures comprise an area of about 10% to about 25% of the cross-sectional area of the reaction vessel. On the contrary, *Chen* teaches *equally-distributed* tubes. (*Chen*, Page 2188 under "bubble column setup and operating conditions;" Figure 2). Moreover, with the disclosed dimension, the cross sectional area ($\pi D^2/4$) of the 16 tubes (one-inch diameter) in the column (18-inch diameter) is about 4.93% ($= 16 \times 1^2 / 18^2$) of

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the total cross-sectional area of the reactor vessel. Thus, *Chen* does not disclose these missing elements as recited in Claim 48. As such, Applicants submit that *Chen* does not anticipate Claim 48, and respectfully request withdrawal of this rejection and allowance of this claim.

VI. Claims 19-23, 27, 29, 31, 40, 42, 45, 46, 48, 65, 68 and 69 are not anticipated by *Hagino*.

Applicants respectfully traverse the rejection of Claims 19-23, 27, 29, 31, 40, 42, 45, 46, 48, 65, 68 and 69 under 35 U.S.C. § 102(b) as being anticipated by *Hagino*. Applicants submit that Claims 19-23, 27, 29, 31, 40, 42, 45, 46, 48, 65, 68 and 69 are not anticipated by *Hagino* because *Hagino* fails to disclose each and every limitation of the claims.

Amended Claims 19 and 48 are independent claims upon which claims 20-23, 27, 29, 31, 40, 42, 45, 46, 65, 68, and 69 depend, respectively. Claim 19, as amended, recites “wherein the plurality of internal structures has a characteristic size *d*, and *d* is from about 2.5 cm to about 13 cm” and further recites “said gas distributor being suitable for passing a gas phase through the liquid into the plurality of reaction zones, and creating a gas flow and a liquid flow in each of the reaction zones”. Claim 48, as amended, recites “wherein the internal structures comprise an area of about 10% to about 25% of the cross-sectional area of the reaction vessel.” Applicants submit that nothing in *Hagino* discloses any of these limitations.

Hagino teaches a bubble column apparatus comprising a draft tube defined by plates 2 and surrounded by a concentric outer periphery (i.e., region between the draft device and the column wall 1). A gas (air) is introduced via an aeration pipe 3 at the bottom of the apparatus in the outer periphery. That is to say, the gas distribution system (aeration pipe 3) in *Hagino*’s apparatus was not designed to deliver gas to the draft tube. Since there is no gas feed to the draft tube, there is a difference in density between the draft tube and the outer periphery (i.e., due to lower gas holdup in the draft tube than in the outer periphery), thus creating significant liquid backmixing in which the liquid in the draft tube has a downward velocity while the liquid in the outer periphery has an upward velocity within *Hagino*’s apparatus. (*Hagino*, Col. 3 lines 8-16). In other words, the arrangement of elements in the apparatus of *Hagino* are designed to cause liquid backmixing and liquid swirling to provide the intense mixing required for microorganism

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growth. Hence, *Hagino* does not disclose said gas distributor being suitable for passing a gas phase through the liquid into the plurality of reaction zones, and creating a gas flow and a liquid flow in each of the reaction zones.

Additionally, *Hagino* does not disclose wherein the plurality of internal structures has a characteristic size d, and d is from about 2.5 cm to about 13 cm. On the contrary, *Hagino* discloses that the size of each plate is 3 m x 50 cm. (*Hagino*, Col. 4, ln. 14). 50 cm is much greater than from about 2.5 cm to about 13 cm. As such, *Hagino* plainly does not disclose wherein the plurality of internal structures has a characteristic size d, and d is from about 2.5 cm to about 13 cm and therefore, does not disclose each and every element of Claim 19.

Secondly, *Hagino* does not disclose wherein the internal structures comprise an area of about 10% to about 25% of the cross-sectional area of the reaction vessel. *Hagino* is silent with respect to the cross-sectional area covered by the plates 2 disposed in the apparatus (see Figure 2). Since there is no disclosure of the thickness of these plates 2, one having ordinary skill in the art would not be able to calculate the envisioned cross-sectional area taken by these plates 2 and thus does not disclose wherein the internal structures comprise an area of about 10% to about 25% of the cross-sectional area of the reaction vessel. For at least these foregoing reasons, *Hagino* does not disclose each and every element of Claim 48.

Because *Hagino* does not disclose each and every element in Claims 19 and 48, it does not anticipate Claims 19 and 48. In view of the recitations in amended Claims 19 and 48, all of which are not disclosed by *Hagino*, Claims 20-23, 27, 29, 31, 40, 42, 45, 46, 65, 68 and 69 are also not anticipated by *Hagino*, as each dependent claim carries with it all the limitations of Claims 19 and 48. In view of the foregoing, Applicants respectfully request the Examiner withdraw the 102(b) rejections of Claims 19-23, 27, 29, 31, 40, 42, 45, 46, 65, 68 and 69, and allowance of the claims.

VII. Claims 19-25, 29-31, 40-43, 45-46, 48, 53, 54, 57, 58 & 65-69 are not anticipated by *Kolbel*.

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The Examiner has rejected Claims 19-25, 29-31, 40-43, 45-50, 53, 54, 57, 58, and 65-69 under 35 U.S.C. § 102(b) as being anticipated by *Kolbel*. Please note that Claims 49-50 are cancelled. Applicants respectfully traverse the rejection of Claims 19-25, 29-31, 40-43, 45, 46, 48-50, 53, 54, 57, 58 and 65-69. Applicants submit that Claims 19-25, 29-31, 40-43, 45, 46, 48, 53, 54, 57, 58 and 65-69 are not anticipated by *Kolbel* because *Kolbel* fails to disclose each and every limitation of the claims.

Claims 19 and 48 are independent claims from which Claims 20-25, 29-31, 40-43, 45, 46, 58 and 65-69 depend, respectively. Claim 19 recites "wherein each reaction zone is in fluid communication with at least one adjacent reaction zone". Claim 48, as amended, recites "said means for reducing comprising a non-uniform distribution of internal structures arranged in such a manner to create a plurality of discrete zones within the reaction vessel." Applicants submit that nothing in *Kolbel* discloses any of these limitations.

Kolbel does not disclose wherein each reaction zone is in fluid communication with at least one adjacent reaction zone. On the contrary, *Kolbel* discloses a column apparatus which is subdivided into similar vertical shafts which have *liquid-tight* casing surfaces. (*Kolbel* col. 3, lns. 53-55; Col. 4 lns 43-44; Figures 4 and 8-9; Claims 1 & 2). For example, *Kolbel* discloses "[a]cross most of the transverse section the column is subdivided into similar, vertical shafts which are open at the top and bottom and have liquid-tight casing surfaces." (*Kolbel*, col. 3, lns. 53-55). Thus, *Kolbel* cannot possibly disclose wherein each reaction zone is in fluid communication with at least one adjacent reaction zone and does not disclose each and every element of Claim 19.

Furthermore, *Kolbel* does not disclose said means for reducing comprising a non-uniform distribution of internal structures. Instead, *Kolbel* unequivocally discloses an even and uniform distribution of shafts along a cross-section of the column as illustrated in Figures 3, 4, 5, 6, 7b, 8, and 9. Thus, *Kolbel* does not disclose all of the elements of Claim 48.

In view of the recitations in amended Claims 19 and 48, all of which are not disclosed by *Kolbel*, Applicants respectfully request that the Examiner withdraw the § 102 rejection and allow Claims 19 and 48. Applicants further request that the Examiner also withdraw the § 102

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rejections of dependent Claims 20-25, 29-31, 40-43, 45, 46, 53, 54, 57, 58 and 65-69. Since it is submitted that independent Claims 19 and 48 are allowable, dependent Claims 20-25, 29-31, 40-43, 45, 46, 58 and 65-69 must *a fortiori* also be allowable because they carry with them all the limitations of the independent claims to which they ultimately refer.

VIII. Claims 26-28, 32, 33, 36, 52, 60-61 and 64 are patentable over *Kolbel*

The Examiner has rejected Claims 26-28, 32, 33, 35, 36, 51, 52, 59-61 and 64 as being unpatentable over *Kolbel*. Please note that claims 35, 51 and 59 are cancelled. Applicants respectfully traverse the Examiner's rejections of Claims 26-28, 32, 33, 36, 52, 60-61 and 64. Applicants submit that contrary to MPEP § 2143, the Examiner has failed to make a *prima facie* case of obviousness in rejecting such claims in that the Examiner has failed to cite references that teach or suggest all of the elements recited in the rejected claims.

Amended Claims 19 and 48 are independent claims upon which Claims 26-28, 32, 33, 36, 52, 60-61 and 64 depend. Claim 19 recites "wherein each reaction zone is in fluid communication with at least one adjacent reaction zone" and Claim 48, as amended, recites "said means for reducing comprising a non-uniform distribution of internal structures arranged in such a manner to create a plurality of discrete zone within the reaction vessel." As discussed in Section VII, *Kolbel* does not teach or suggest any of these elements. Because Claims 26-28, 32, 33, 36, 52, 60-61 and 64 depend on either of Claims 19 and 48, Claims 26-28, 32, 33, 36, 52, 60-61 and 64 are not obvious at least for the same reasons set forth for Claims 19 and 48. Accordingly, Applicants respectfully request withdrawal of this rejection and allowance of such claims.

IX. Claims 19-26, 29, 37-46, 48, 53-58, 62, 63, 65, 68 and 69 are patentable over *Garbo*.

The Examiner has rejected Claims 19, 20-26, 29, 37-46, 48-50, 53-58, 62, 63, 65, 68, and 69 as being unpatentable over *Garbo*. Please note that Claims 49-50 are cancelled. Applicants respectfully traverse the Examiner's rejections of Claims 19-26, 29, 37-46, 48, 53-57, 62, 63, 65, 68 and 69. Applicants submit that contrary to MPEP § 2143, the Examiner has failed to make a *prima facie* case of obviousness in rejecting such claims in that (1) the Examiner has failed to

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cite references that teach or suggest all of the elements recited in the rejected claims, and (2) the Examiner has failed to articulate a motivation or suggestion to modify the reference with a reasonable expectation of success.

Amended Claim 19 recites "a reaction vessel characterized by an internal diameter D_r of greater than or equal to 0.6 m." Claim 19 also recites "wherein the plurality of internal structures has a characteristic size d , and further wherein d is from about 2.5 cm to about 13 cm." Amended Claim 48 recites "said means for reducing comprising a non-uniform distribution of internal structures arranged in such a manner to create a plurality of discrete zone within the reaction vessel." Applicants submit that nothing in *Garbo* teaches or suggests these limitations.

Nowhere does *Garbo* teach or suggest a reaction vessel characterized by an internal diameter D_r of greater than or equal to 0.6 m or wherein the plurality of internal structures has a characteristic size d , and further wherein d is from about 2.5 cm to about 13 cm. For example, the Examiner indicates that "Garbo is silent as to the specific internal diameter D_r for the reaction vessel 10." (Office Action, pg. 15, lns. 11-12). Moreover, *Garbo* is silent as to the size of the plurality of internal structures as well. As such, *Garbo* does not teach or suggest all of the limitations of Claim 19.

Furthermore, *Garbo* does not teach or suggest said means for reducing comprising a non-uniform distribution of internal structures arranged in such a manner to create a plurality of discrete zones within the reaction vessel. Rather, *Garbo* teaches a completely uniform arrangement of internal structures. (*Garbo*, Figures 1 and 2). For instance, *Garbo* teaches "[t]he tubes 16 are preferably *uniformly spaced* . . . so that the fresh feed gas flowing outwardly through the apertures 18 is rather well distributed through the mass of catalyst." (*Garbo*, col. 4, lns. 6-8 (Emphasis added)). Plainly, *Garbo* does not teach or suggest a non-uniform distribution of internal structures. Accordingly, *Garbo* does not teach or suggest all the limitations of Claim 48.

Applicants therefore respectfully submit that the Examiner has not articulated a *prima facie* case of obviousness in rejecting claim 144, because, contrary to MPEP § 2143, the

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Examiner has failed to cite references that teach or suggest all of the elements recited in the rejected claim.

Furthermore, contrary to MPEP §§ 2143.01 and 2143.02, the Examiner has failed to articulate a motivation or suggestion to modify *Garbo* with a reasonable expectation of success with respect to Claims 19 and 48. Applicants respectfully submit that the *prima facie* case of obviousness is thus yet further lacking. The Examiner additionally has taken Official Notice that changes in size merely involves routine skill in the art. (Office Action, pg. 15, lns. 16-17). Applicants respectfully traverse this assertion.

Applicants submit that it would not be obvious to one skilled in the art to arbitrarily choose an internal diameter D_r of greater than or equal to 0.6 m with the configuration taught in Claim 19 because it is well known in the art that fluidized and slurry bubble reactor scale-up is notoriously difficult and unpredictable. Krishna et al. (in "*A scale-up strategy for a commercial scale bubble column slurry reactor for Fischer-Tropsch synthesis*", *Oil & Gas Science and Technology* (2000), Vol. 55 (Issue 4), pp. 359-393) states that the "[s]uccessful commercialization of this technology is crucially dependent on the proper understanding of the scaling-up principles of bubble columns for the above mentioned conditions *which falls outside the purview of most published theory and correlations.*" (Emphasis added). He further states that "... *the hydrodynamics is significantly affected by column diameter, elevated system pressure, concentration of the slurry. These effects are not adequately described by published literature correlations*" (Emphasis added)). As an example, Saxena (in "*Bubble Column and Fischer-Tropsch Synthesis*", *Catal Rev.-Sci. Eng.* 37(2) (1995) p. 292) teaches that "[t]he hydrodynamics of baffled bubble columns . . . *needs to be investigated and correlated* to understand mass transfer behavior. It is clear from the data discussed in this review that conclusions drawn based on data for aqueous systems *are of very little validity to predict the behavior of actual viscous systems* and particularly at temperatures and pressures above the ambient." (Emphasis added). Finally, Sie & Krishna (in "*Fundamentals and selection of advanced Fischer-Tropsch reactors*", *Applied Catalysis A: General* (Oct. 4, 1999) Vol. 186, Issues 1-2, p. 65) indicates that "... the direct use of process data from pilot-plant reactors (where

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the hydrodynamics may deviate considerably from those in an industrial reactor) for a commercial design is in general *not possible without taking unduly large risks*". (Emphasis added). Please note that these three references are already listed in PTO/SB/8B forms submitted by Applicants in the Information Disclosure Statements.

Moreover, a small change in the internal diameter of a reactor results in large changes in hydrodynamics within the reactor. For instance, it is known in the art that reactor productivity dramatically decreases with increasing reactor diameter because the liquid axial dispersion coefficient increases with increasing diameter. (Applicant's Specification as filed, para. [0023] and Figure 3). Thus, the selection of a reactor diameter does not merely involve routine skill in the art, but requires an extensive understanding of the effect that a larger diameter will have on the operability and performance of the larger-size reactor. As noted above, the prior art teaches that the predictive tools available in the public domain are not sufficient to achieve commercial success and that understanding of the effect of the larger diameter is not obtained as part of a routine experimentation, but involves resolving complex multiphase flow equations and operating such reactors at various scales. As such, one of ordinary skill in the art would not modify *Garbo* with an internal diameter D_r of greater than or equal to 0.6 m with a reasonable expectation of success. Hence, the Examiner has failed to articulate a motivation or suggestion to modify *Garbo* with a reasonable expectation of success.

Accordingly, Applicants respectfully request that the Examiner withdraw the § 103 rejections and allow Claims 19 and 48. Since independent Claims 19 and 48 are submitted to be allowable, dependent Claims 20-26, 29, 37-46, 53-57, 62, 63, 65, 68 and 69 must *a fortiori* also be allowable, since they carry with them all the limitations of Claims 19 and 48.

X. Conclusion

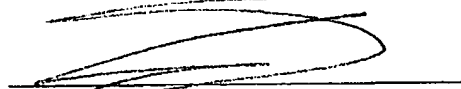
Applicants respectfully request reconsideration, allowance of the pending claims and a timely Notice of Allowance be issued in this case. If the Examiner feels that a telephone conference would expedite the resolution of this case, the Examiner is respectfully requested to contact the undersigned.

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In the course of the foregoing discussions, Applicants may have at times referred to claim limitations in shorthand fashion, or may have focused on a particular claim element. This discussion should not be interpreted to mean that the other limitations can be ignored or dismissed. The claims must be viewed as a whole, and each limitation of the claims must be considered when determining the patentability of the claims. Moreover, it should be understood that there may be other distinctions between the claims and the prior art which have yet to be raised, but which may be raised in the future.

If a petition for extension of time is necessary in order for this paper to be deemed timely filed, please consider this a petition therefore. If any fees are inadvertently omitted or if any additional fees are required or have been overpaid, please appropriately charge or credit those fees to Conley Rose, P.C. Deposit Account Number 03-2769.

Respectfully submitted,



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